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ABSTRACT

This study was conducted to investigate the long-term validity of the Japanese version of the Denver Developmental Screening Test (JDDST). Participating in the initial assessment were 1230 children in Tokyo and 600 children in Iwate who were between 1 month and 6 years of age when assessed between 1975 and 1979. Participants in the 1983 and 1985 follow-ups were those subjects who were aged 1 to 24 months, 25 to 48 months, or 49 to 72 months at the time of initial assessment and located at the same address they had been when first assessed. For follow-up, questionnaires inquiring into the present status of subjects at school and home were mailed to teachers and mothers. Three ratings were used to classify mothers' and teachers' evaluations of the children: normal or above normal, borderline, and retarded or classified for special education. Questionnaires were returned for 532 Tokyo and 463 Iwate children. In the northern, rural Iwate area, a modified form of the JDDST was used in the follow-up; this form took climate and urbanization factors into consideration. Long-term validity of the initial JDDST testing in Iwate was evaluated by comparing results on both original and modified forms of the test with initial results on the original form. Findings are discussed. (RH)

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Infant and Pre-school Developmental Screening Test (JDDST) and Later Development

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It is generally known that the predictive value of DQ in infancy is rather low for later developmental status at the school age, as far as normal children are concerned(Honzick,M.P.,et al., 1948). However, Drillien,D. (1961) and Illingworth,R.S.(1963) have reported that infants with DQ below 70 tended to stay under 70 at school age and they suggest the possibility of the prediction of later mental retardation from developmental tests during infancy.

The present study was conducted in order to investigate the long-term validity of the Japanese version of Denver Developmental Screening Test(JDDST) by the follow-up of the standardizataion subjects after 6 to 8 years.

Subjects: In 1975 - 1979, 1230 children in Tokyo and 600 children in Iwate who were between 1 months and six years of age were administered the JDDST. In the two JDDST follow-up studies in 1983 - 1985, those subjects who satisfy the following two conditions were selected from the original 1830 children. The condition were; 1)Either 1 to 24 months, 25 to 48 months, or 49 to 72 months at the time of the primary JDDST testing. 2) Residents staying at the same address as in the primary testing.

Method: Questionnaires inquiring the present status of the subjects both at school and home were mailed to the teachers and mothers of all the subjects. When possible, interviews and intelligence tests were conducted to the same subjects to test the validity of the answers of the questionnaire.

Three ratings were used to classify the mothers' evaluation of the children, such as 1)normal and over, 2)borderline, 3)already classified into special education (or high probability of being classified into special education). ISS(Intelligence Standard Scores) given by teachers' report were classified into three ratings of more than 45(normal), from 36 through 44(borderline) and below 36(retardation). Agreement ratio between the results

by mothers and teachers was 88%.

Results: 1. Follow-up in Tokyo

In Tokyo group, there were 578 children who satisfied the above two conditions. There was the response to the questionnaire from 532 out of 578(92%).

Table 1 shows the ratings at the follow-up of 386 children who were identified as normal at the initial JDDST testing. This table demonstrates that the majority of children remained normal after 6 to 8 years, but there were a few borderline and retarded cases in each of the three age groups. Overall frequencies of retarded children were 1.3 to 2.2% which were close to the average ratio of 2.1% of Japanese children in general. Table 1

Table 2 indicates the ratings at the follow-up of 146 children who were identified as non-normal at the initial JDDST testing. 1) Seventy-nine percent of questionable and 32% of abnormal have become normal during the development into school age. 2) Retarded children were identified from each group, such as 11.2% from "questionable" and 56.6% from "abnormal". Table 2

Table 3 indicates the follow-up ratings of those who were identified as non-normal in relation to the age of initial JDDST administration. Retarded children were found in each age group such as 12% in under 24 months, 44% in 25 to 48 months and 65% in 49 to 72 months. These results shows that the higher is the childrens' age of initial testing, the more is the ratio of the retarded children. The probability of early identification of risk children by the JDDST is likely to increase with the children's age. Therefore, the long-term validity of the JDDST seems to be quite similar to that of the diagnostic developmental and IQ tests administered in preschool years. Table 3

2. Follow-up study in Iwate

In Iwate group, there were 508 children who satisfied the above two conditions. From those, 463 questionnaires were returned(91%). The results of the JDDST in Iwate was interpreted by using the modification of the JDDST from northern rural area which took climate and urbanization factors into consideration. The modification was one of the most important results of the standardization study of the JDDST, as reported before (Ueda,R. 1978b & 1980).

In the standardization study in 1980, discrepancies in developmental norms between Tokyo and Iwate children were evident in the gross motor sector in early infancy and in the language sector in preschool age. The test items "head control" and "roll over" and other items in early infancy were passed later by Iwate infants at 50% and 90% points. In language sector, the passing of items "Defines six words" and "Composition of words" were much delayed in Iwate children. Considering these discrepancies in developmental norms within sub-culture of Japan, modified forms of the JDDST had been devised to reduce false positive and/or false negative. By using these modified forms,short-term validity of the JDDST was improved. In this follow-up study in Iwate, the long-term validity of the initial JDDST testing was evaluated by comparing the result according to modified criteria with that of non-modified criteria.

Table 4 shows the ratings at the follow-up of 391 children who were Table 4
identified as normal at the initial JDDST testing according to the modified criteria. In each of the three groups of age of the initial JDDST administration, a few borderline and retarded children were found after 6 to 8 years.

Table 5 shows the ratings at follow-up of 72 children who were Table 5

identified as non-normal according to the modified criteria of JDDST. While retarded children were identified in 12% of "questionable" group and 67% of "abnormal" group in the JDDST ratings, there were 66% and 0% of normal children from "questionable" and "abnormal" respectively.

It is very important that the follow-up results could have been different without the use of the modified criteria of the JDDST. Table 6 shows the same results as table 5, when the modified criteria were not used. This procedure means that the Tokyo norms were applied to Iwate children for developmental screening. It shows that there would have been normal children from 21% of initial "abnormal" group without the modified criteria.

Discussion: Few studies on the long-term validity of developmental and/or intelligence tests in infancy and pre-school years has been undertaken in Japan. Little attention has been paid to both short-term and long-term validity of developmental screening tests. In the process of the standardization of the JDDST, the author studied the short-tem validity of the JDDST and confirmed that the correlation between the JDDST ratings and the DQ and/or IQ were high as K=0.59(Ueda,R. 1978a). An investigation of the long-term validity of infant and pre-school developmental tests was attempted in this study in order to know the predictability of the JDDST, partly because development during childhood is known to be rapid and full of plasticity(McCall,R.B. 1981, Ueda,R. 1985).

In this study, 744 out of 1830 could not follow because of the main reason of removal of the subjects. Comparing the backgrounds of the respondent with the non-respondent, there were no significant difference between them

and there would be no high deviance in results of this study.

Frequencies of retarded children are different according to the ages of the subjects as well as the socio-cultural backgrounds. It appears that the frequencies of retarded children in infancy and pre-school years are relatively low but become higher in school ages, reaching at peak from 10 to 14 years old and then decreasing after 15 years old(Koike,1971). As far as normal JDDST ratings are concerned, the majority of children remained normal after 6 to 8 years, but there were a few borderline and retarded cases in this study. Frequencies of retarded children were 1.3 to 2.2%(Tokyo) and 1.0 to 3.7%(Iwate) which were close to the average ratio of 2.1% of Japanese school children in general. But the ratio of this study was lower than that of 8.1% in a special cohort study done by us(Ueda,R. 1985) in an urban community of Tokyo. This difference could be explained by both bio-social backgrounds of the subjects and evaluation methodology(different kinds of tests used). The subjects of this study were drawn from broad Metropolitan Tokyo, while the subjects of the special cohort study were from the urban community of Tokyo where infant mortality rate was higher than average of Tokyo and high risk of maternal and child health problems was suspected.

Concerning the non-normal JDDST in Tokyo, 79% of questionable and 32% of abnormal have become normal during the development into school age. These results might indicate the rapid developemt in infants and pre-school years as well as an increasing changes in the ratings of developmental evaluation. This latter point was confirmed by the analysis of the follow-up ratings of those who were identified as non-normal at the time of initial JDDST administration.

Normal children were found in each age group such as 85% in under 24 months at the initial JDDST administration, 34% in 25 to 48 months and 17% in 49 to 72 months. If abnormal JDDST ratings are considered, there was significant difference between the age group under 24 months and that over 25 months(See Table 7). From 10 to 12 % of abnormal ratings of initial JDDST administration in over 25 months became normal while 81% in under 24 months turned out to be normal.

These results were similar to report by von Doornick,W.J.(1976) after 5 -6 years follow up study. He found that 11%(4 out of 34) had changed from abnormal ratings to normal and also 3 out of 4 were in age group under 24 months. One reason for the low predictive accuracy of the DDST abnormals for children screened below 24 months of age may be due to the fact that 5 to 6 years later the children were only in first or second grade and therefore had not had time to meet all of the school failure criteria(Frankenburg,W.K.1985). In other words, the probability of early identification of risk children by the JDDST is likely to increase with the childrens age. Therefore, the long-term validity of the JDDST seems to be quite similar to that of the diagnostic and IQ tests administered in pre-school years.

Human development is a dynamic, multiply determined process. It is impossible to explain what kind of specific factors have influenced in the changes of developmental status of subjects from infancy to school children. However, plasticity in human development might be considered. According to Lerner (1984), plasticity encompasses the systematic changes within the person in his or her structure and/or function. These changes occur throughout the life span and are found at all levels from the biological to the cultural. Moreover, the degree of changes are especially rapid during infancy and pre-

school years. Therefore, the results of developmental and/or intelligent tests during these years have little predictive value of childrens competence in school years. At the same time, it could be pointed out that the existing tools of developemntal evaluation in infancy and pre-school years have limited power of prediction of later development.

Short-term validity by using the modification of the JDDST had been already conformed(Ueda,R. 1978). In this study, the follow-up of subjects in Iwate was conducted in order to confirm the long-term validity by using the modification of the JDDST. On follow up study with a time span of 5 to 6 years, von Doornick(1976) found that 89% of the abnormals and 63% of the questionables on the initial JDDST were classified as having school problems respectively. However, this findings should be viewed with the realization that the study was done for low SES(Socio-Economic Status) population who would be higher than the prevalence in children from high SES populaltion (Frankenburg,W.K. 1985). In this study, the rate of school problems among children with the initial JDDST ratings of "Non-Normal" in Iwate was 41.7% - 44.8%(Table 5 & 6). The rate of school children with retardation by IQ and/or ISS was 18.1% - 14.9%(Table 5 & 6). These results of the predictive accuracy seems to be reasonable, considering backgrounds of the subjects as a cross-sectional population in Iwate.

In addition, it was found that the rate of false positive could be much reduced from 21.4% to 0% in the initial "abnormal" group of the JDDST using the modification of the JDDST(Table 5) and the long-term validity improved by using the modified criteria of the JDDST in northern and rural area as Iwate. In other words, these results might suggest that socio-cultural as well as geographycal environment of children should be considered in the interpretation of developmental evaluation, especially in early childhood.

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Table 1 Follow-up of Children with JDDST Rating of "Normal" - Tokyo

n=386

Age at Initial JDDST	Rating at Follow-up			
	Normal	Borderline	Retardation	Total
under 24m	202 (92.7)	13 (6.0)	3 (1.3)	218 (100%)
- 48	80 (88.9)	8 (8.9)	2 (2.2)	90 (100)
- 72	72 (92.3)	5 (6.4)	1 (1.3)	78 (100)
Total	354 (91.7)	26 (6.7)	6 (1.6)	386 (100)

Table 2 Follow-up of Children with JDDST Rating of "Non-Normal" - Tokyo

N=146

Classification of Initial JDDST	Rating at Follow-up			
	Normal	Borderline	Retardation	Total
Questionable	70 (78.7)	9 (10.1)	10 (11.2)	89 (100%)
Abnormal	17 (32.1)	6 (11.3)	30 (56.6)	53 (100)
Untestable	1 (25)	0	3 (75)	4 (100)
Total	88 (60.3)	15 (10.3)	43 (29.4)	146 (100)

Table 3 Follow-up of Children with JDDST Rating of "Non-Normal" - Tokyo

N=146

Age at Initial JDDST	Rating at Follow-up			
	Normal	Borderline	Retardation	Total
under 24m	70 (85.4)	2 (2.4)	10 (12.2)	82 (100%)
- 48	14 (34.1)	9 (22.0)	18 (43.9)	41 (100)
- 72	4 (17.4)	4 (17.4)	15 (65.2)	23 (100)
Total	88 (60.3)	15 (10.3)	43 (29.4)	146 (100)

Table 4 Follow-up of Children with JDDST Rating of "Normal" - Iwate(Modified)

N=391

Age at Initial JDDST	Rating at Follow-up			
	Normal	Borderline	Retardation	Total
under 24m	189 (78.8)	42 (17.4)	9 (3.7)	240 (100%)
- 48	70 (72.9)	25 (26.0)	1 (1.0)	96 (100)
- 72	42 (76.40	11 (20.0)	2 (3.6)	55 (100)
Total	301 (77.0)	78 (19.9)	12 (3.1)	391 (100)

Table 5 Follow-up of Children with JDDST Rating of "Non-Normal" - Iwate(Modified)

N=72

Classification of InitialJDDST	Rating at Follow-up			
	Normal	Borderline	Retardation	Total
Questionable	38 (65.5)	13 (22.4)	7 (12.1)	58 (100%)
Abnormal	0	3 (33)	6 (67)	9 (100)
Untestable	4 (80)	1 (20)	0	5 (100)
Total	42 (58.3)	17 (23.6)	13 (18.1)	72 (100)

Table 6 Follow-up of Children with JDDST Rating of "Non-Normal" - Iwate(Not Modified)

N=87

Calssification of Initial JDDST	Rating at Follow-up			
	Normal	Borderline	Retardation	Total
Questionable	41 (60.3)	21 (30.9)	6 (8.8)	68 (100) %
Abnormal	3 (21.4)	4 (28.6)	7 (50.0)	14 (100)
Untestable	4 (80)	1 (20)	0	5 (100)
Total	48 (55.2)	26 (29.9)	13 (14.9)	87 (100)

Table 7 JDDST"Abnormal" and the Age tested

Age at Initial JDDST	Rating at Follow-up			
	Normal	Borderline	Retardation	Total
under 24m	13 (81)	0	3 (19)	16 (100%)
- 48	2 (12)	2 (12)	13 (77)	17 (100)
- 72	2 (10)	4 (20)	14 (70)	20 (100)

Summary

Few studies on the long-term validity of developmental and/or intelligence tests in infancy and pre-school years has been undertaken in Japan. Little attention has been paid to both short-term and lonf-term validity of developmental screening tests.

The present study was conducted in order to investigate the long-term validity of the Japanese version of Denver Developemntal Screening Test(JDDST) by the follow-up of the 1830 standardization subjects(Tokyo; 1230, Iwate;600). Questionnaires inquiring the present status of the subjects both at school and home were mailed to the teachers and mothers of all the subjects. When possible, interviews and intelligence tests were conducted to the same subjects to test the validity of the answers of the questionnaire.

As far as normal JDDST ratings are concerned, the majority of children remained normal after 6 to 8 years, but there a few borderline and retarded cases. Frequencies of retarded children were 1.3 to 2.2% which were close to the average ratio of 2.1% of Japanese school children in general.

Concerning the non-normal JDDST, 79% of questionable and 32% of abnormal became normal during the development into school age. Also, the results showed that the higher was the childrens age of initial testing, the more was the ratio of the retarded children.

Finally, the follow-up study in Iwate showed that the rate of false positive could be much reduced and the long-term validity could be more improved by using the modified criteria of the JDDST in northern and rural area as Iwate. In other words, these results might suggest that socio-cultural as well as geographycal environment of children should be considered in the interpretation of developmental evaluation, especially in early childhood.